

The opinion in support of the decision being entered today was not written for publication in a law journal and is not binding precedent of the Board.

Paper No. 26

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES

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Ex parte DARIUS L. CRENSHAW and PROMOD KUMAR

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Appeal No. 2001-1384  
Application No. 08/726,229

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ON BRIEF

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Before KRASS, GROSS and SAADAT, Administrative Patent Judges.  
KRASS, Administrative Patent Judge.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1-13. Claims 14-20 have been allowed by the examiner and do not form part of this appeal.

The invention is directed to a method of fabricating a dynamic random access memory (DRAM) to increase the capacitance thereof. The higher capacitance is provided by the fabrication of a micro-villus pattern, a three-dimensional pattern on the

capacitor bottom electrode, formed via a mask. The mask is made of small particles which are controlled as to size and distribution, enabling the formation of a dense, evenly-spaced micro-villus pattern, optimizing the increase in capacitor electrode surface area, thereby increasing capacitance.

Representative independent claim 1 is reproduced as follows:

1. A method of forming a dynamic random access memory cell having a storage capacitor, comprising:

precipitating a plurality of particles in a microemulsion mixture;

forming a lower electrode layer;

depositing the particles in an evenly spaced layer on the lower electrode layer;

using the deposited particles as a mask to form a micro-villus pattern on the lower electrode layer;

removing the particles leaving the micro-villus pattern on the lower electrode layer;

forming a dielectric overlying the micro-villus pattern; and

forming an upper electrode of the storage capacitor.

The examiner relies on the following references:

|                                |           |               |
|--------------------------------|-----------|---------------|
| Ahn                            | 5,158,905 | Oct. 27, 1992 |
| Kavassalis et al. (Kavassalis) | 5,209,998 | May 11, 1993  |
| Cathey et al. (Cathey)         | 5,244,842 | Sep. 14, 1993 |
| Jun et al. (Jun)               | 5,256,587 | Oct. 26, 1993 |

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(Japanese Patent Application)  
Morimoto et al.

JP 1-119049

May 11, 1989

Watanabe et al. "A New Cylindrical Capacitor Using Hemispherical Grained Si (HSG-Si) for 256Mb DRAMs" IDEM 92, 1992, IEEE pp. 259-262. (Watanabe)

Additionally, the examiner relies on admitted prior art [APA], as described at page 11 of the specification.

Claims 1-13 stand rejected under 35 U.S.C. 103. As evidence of obviousness, the examiner cites Ahn or Cathey in view of APA, Jun, Morimoto, Watanabe and Kavassalis.

Reference is made to the briefs and answer for the respective positions of appellants and the examiner.

#### OPINION

It is the examiner's position that either one of Cathey, Morimoto or Ahn discloses the deposition of a particle colloidal solution evenly on a lower electrode, forming a micro-villus pattern by using the particles as a mask, removing the particles, and forming a capacitor dielectric layer and top electrode. The examiner also notes that APA teaches the formation of silica particles in the solution to form a microemulsion, that Jun

discloses formation of HSG particles on a mask layer and that Watanabe discloses the formation of a capacitor on a semiconductor substrate, including forming a lower electrode, forming a layer of rough poly (HSG), and forming a capacitor dielectric layer and top electrode.

While the examiner recognizes that neither Ahn nor Cathey explicitly mentions "microemulsion for particle solution" [answer-page 6]<sup>1</sup>, the examiner relies on Kavassalis for the teaching of a colloidal particle solution being a microemulsion. Accordingly, the examiner concludes, it would have been obvious "to have **recognized** that colloidal solution is a microemulsion as taught by Kavassalis et al., Admitted prior art because microemulsion contains the colloidal particles in the solution and forming particles layer as an etch mask to form micro-villus pattern" [answer-page 6].

For their part, appellants do not contest the examiner's alleged teachings provided by the various references nor that a case for obviousness, within the meaning of 35 U.S.C. 103, can be made if the references were properly combinable. Rather, appellants argue that Kavassalis is non-analogous art because

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<sup>1</sup>At this point in the rejection, it is unclear what role the examiner has for the Jun, Watanabe, Morimoto and APA references.

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Kavassalis is not within the same field of endeavor as the present invention, directed, instead, to the field of producing colored particles, such as used in electrostatic toners for color photocopiers and printers, and for other colorants. Appellants point out that there is no mention in Kavassalis of any applicability to the field of integrated circuit fabrication, much less to a method of forming a DRAM cell.

Moreover, appellants argue that Kavassalis is not even reasonably pertinent to the particular problem with which the inventors were involved since appellants were addressing limitations in the formation of micro-villus patterned DRAM cells, particularly in optimizing the increase in surface area of the DRAM capacitors, and Kavassalis is not even remotely directed to this problem.

Since Kavassalis is not directed to analogous art, argue appellants, it may not be properly applied in a combination of references in order to reject the instant claimed subject matter.

Even though appellants, themselves, refer to the Kavassalis reference at page 11 of the instant specification, for the purpose of describing a technique for forming a microemulsion, we agree with appellants that Kavassalis would appear to be a non-analogous reference to both the instant claimed subject matter

and the primary references because Kavassalis is neither directed to appellants' field of endeavor nor reasonably pertinent to the problem confronting appellants.

In any event, while Kavassalis may, indeed, show how to form a microemulsion, the more important question, under an analysis, within the meaning of 35 U.S.C. 103, is what would have led the artisan, having the teachings of the primary references before him/her, to seek to place the particles of, for example, Ahn or Cathey, in a "microemulsion mixture," as claimed?

Appellants allege that it was they who recognized that particles precipitated from a microemulsion may be beneficially used in the formation of micro-villus patterns on DRAM capacitor electrodes. Thus, while Kavassalis, even if a viable reference, might show that microemulsions were known, there must still be some evidence of motivation, i.e., something that would have led the artisan, to use such a well-known microemulsion from which to precipitate the particles in Ahn or Cathey. Kavassalis provides no such motivation.

With this much, we agree with appellants. However, the examiner's rationale is more than a substitution of Kavassalis' microemulsion into the primary references. Rather, the examiner contends that the particle solutions of Ahn and Cathey are

microemulsion mixtures but merely not labeled as such. The examiner contends that while Ahn calls the particle solution a "colloidal dispersion" [column 4, lines 36+] and Cathey calls the solution a "colloidal silica slurry" [column 3, lines 29+], that a microemulsion is a colloidal solution and that, therefore, the claimed "microemulsion mixture" is taught by either one of Ahn or Cathey.

While a microemulsion might be a colloidal solution and vice-versa, it would appear to us that the size of the particles in the mixture or solution would dictate whether a mixture is a "microemulsion." In view of no apparent denial by appellants that, as alleged by the examiner, the colloidal solutions of Ahn and Cathey are, in fact, "microemulsion" mixtures, we find that these primary references do suggest such a "microemulsion mixture," as claimed.

Appellants' argument goes a step farther in contending that neither Ahn nor Cathey teaches the claimed "precipitating" step. Thus, even if Ahn's mixture of particles in a "colloidal dispersion" and if Cathey's mixture of particles in a "colloidal silica slurry" may be considered microemulsion mixtures, neither reference suggests the precipitation of these particles in a microemulsion mixture, as claimed. We agree with appellants.

A precipitate is "a substance separated from a solution or suspension by chemical or physical change."<sup>2</sup> The step of "precipitation" in the context of the instant invention would be the separation of the particles in the microemulsion mixture. The question to be answered, then, is whether Ahn or Cathey teaches or suggests that the particles are separated from the colloidal solutions. While it is not very clear as to whether, in fact, Ahn or Cathey actually discloses a "precipitating" step, it would appear that particles in each of these references are separated from the colloidal solution since the end result is a coating of solid particles forming the micro-villus patterns.

Importantly, however, is that even if the primary references do, in fact, suggest a precipitating step, the instant claims do not merely call for precipitating a plurality of particles in a microemulsion mixture. Rather, this step of the recited method claims, is the first step in a sequence of claimed steps. Accordingly, there must first be a precipitating of the particles in a microemulsion mixture. Then, the lower electrode is formed and the particles are deposited on the lower electrode. Contrary

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<sup>2</sup>Webster's Ninth New Collegiate Dictionary; 1985.



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to this, both Ahn and Cathey deposit the colloidal mixture on the first conductive layer (electrode) and any precipitation that does occur occurs at a later time, *after* deposition (see, for example, Ahn, column 4, lines 31-40). The remaining applied references are of no help in providing this deficiency of the primary references.

Accordingly, we find that the examiner has not established a prima facie case of obviousness with regard to the instant claimed subject matter and we will not sustain the rejection of claims 1-13 under 35 U.S.C. 103.

The examiner's decision is reversed.

REVERSED

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|-----------------------------|---|-----------------|
| ERROL A. KRASS              | ) |                 |
| Administrative Patent Judge | ) |                 |
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|                             | ) |                 |
| ANITA PELLMAN GROSS         | ) | BOARD OF PATENT |
| Administrative Patent Judge | ) | APPEALS AND     |
|                             | ) | INTERFERENCES   |
|                             | ) |                 |
|                             | ) |                 |
| MAHSHID D. SAADAT           | ) |                 |

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